

CURRICULUM VITAE

PART I: GENERAL INFORMATION

DATE PREPARED: April 2002

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Date/Place of Birth: July 28, 1958; Istanbul, Turkey

Education:

1982	B.S.	Mechanical Engineering	Istanbul Technical University (Summa Cum Laude)
1985	M.S.	Mechanical Engineering	Massachusetts Institute of Technology
1989	Ph.D.	Medical Engineering	Harvard- Mass Institute of Technology Division of Health Sciences and Technology

Postdoctoral Training:

1990	Postdoc	Cell Injury and Stress	Massachusetts Institute of Technology
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Academic and Professional Appointments:

1990-1996	Assistant Professor of Surgery (Bioengineering) Massachusetts General Hospital, Harvard Medical School
1996-	Associate Professor of Surgery (Bioengineering) Massachusetts General Hospital, Harvard Medical School

Hospital or Affiliated Institution Appointments:

1990-1996	Assistant Bioengineer, Massachusetts General Hospital
1990-	Senior Scientific Staff, Shriners Burns Hospital
1994-	Affiliated Faculty, Division of Health Sciences and Technology Harvard-Massachusetts Institute of Technology

1996- Associate Bioengineer, Massachusetts General Hospital
2001- Bioengineer, Massachusetts General Hospital

Other Professional Positions and Major Visiting Appointments:

1990-1994 Lecturer, Department of Mechanical Engineering
Massachusetts Institute of Technology
1993-1994 Visiting Assistant Professor, Rutgers University
Department of Chemical and Biochemical Engineering

Major Administrative Responsibilities:

1995- Director, Biomedical Engineering Research and Education Program
Center for Engineering in Medicine, Massachusetts General Hospital
1998- Associate Director, Center for Engineering in Medicine
Massachusetts General Hospital
1998- Director, Microsystems Bioengineering Core Facility
Center for Engineering in Medicine, Massachusetts General Hospital

Major Committee Assignments:

Medical School or Affiliated Institutions:

<u>Year</u>	<u>Name of Committee</u>	<u>Role</u>	<u>Institution</u>
1993-1995	Research Committee	Member	MGH
1994-	Graduate Faculty Committee	Member	Harvard-MIT HST
1997-	Comm to Review Research Proposals	Member	MGH
1998-2000	Harvard Bioeng Program Committee	Co-Chair	HST/DEAS
1998-	Graduate Admissions Committee	Member	Harvard-MIT HST

Regional or National:

<u>Year</u>	<u>Name of Committee</u>	<u>Role</u>	<u>Institution</u>
1995-	Scientific Advisory Board	Member	Organogenesis, Inc.
1998	CAREER Award Panel in Bioeng	Member	National Science Foundation
1999	Panel on Nanoscale Biosystems	Member	National Science Foundation
1999	CAREER Award Panel in Bioeng	Member	National Science Foundation
2000	Strategic Planning Committee for Cell Stasis Science	Member	Defense Advanced Research Projects Agency (DARPA)
2000	Panel on Nanotechnol and Tissue Eng	Member	National Institutes of Health Bioengineering Consortium
2000	Panel on Storage and Translational Issues in Reporative Medicine	Moderator	National Institutes of Health Bioengineering Consortium

Professional Societies:

<u>Year</u>	<u>Society</u>	<u>Role</u>
1984 -	Society for Cryobiology	Member
1986 -	American Society of Mechanical Engineers	Member
1992 -	Biomedical Engineering Society	Member
1992-	American Society of Mechanical Engineering K-17 Committee on Heat & Mass Transfer in Biotech	Member
1992-	American Institute of Chemical Engineers	Member
1992-	Biophysical Society	Member
1993 -	Cell Transplantation Society	Member
1993-	New York Academy of Sciences	Member
1995-1996	Society for Cryobiology Committee to Promote the Field of Cryobiology	Member
1997 -	American Burn Association	Member
1997-	Tissue Engineering Society	Member
1997-1999	Biomedical Engineering Society National Program Committee	Member
1999-	Society for Cryobiology	Board of Governors
1999-2000	American Society for Testing and Materials Liver Task Group for Tissue Eng Products	Chair
2000-2002	Society for Cryobiology	President-elect
2001-	Society for Cryobiology, Program Committee	Chair
2002-2004	Society for Cryobiology	President

Community Service Related to Professional Work:

Meeting Sessions Organized/Chaired:

<u>Year</u>	<u>Role</u>	<u>Session/Meeting</u>
1991	Chair	Session "Communications in Rapid Solidification Techniques" Annual Meeting of Society for Cryobiology, Belgium
1992	Chair	Session "Transport Phenomena in Biotechnology" National Heat Transfer Conference, CA
1992	Chair	Session "Biomaterial-Ice Interactions" Annual Meeting of Society for Cryobiology, Cornell University, NY
1993	Chair	Session "Bioartificial Organs" American Institute of Chemical Engineers, Meeting, MO
1993	Chair	Session "Structure and Dynamics in Tissue Engineering" Summer Bioengineering Conference, CO
1994	Co-Chair	Meeting "XI Congress of the International Society for Artificial Cells, Blood Substitutes, and Immobilized Biotechnology" MA

1995	Chair	Session "Advances in Cryobiology and Cryomedicine" International Mechanical Engineering Congress & Exposition, CA
1995	Chair	Session "Targeted Delivery of Drugs and Genes" AAAS Annual Meeting, GA
1995	Chair	Session "Tissue Engineering and Gene Therapy" Biochemical Engineering IX, Switzerland
1995	Chair	Session "Genetic and Immunotechnology" American Institute of Chemical Engineers Meeting, FL
1996	Chair	Session "Symposium on Tissue Engineering: The Next Generation of Medical Implants" International Mechanical Engineering Congress & Exposition, GA
1996	Chair	Session "Symposium on Nucleation, Crystallization, and Phase Change in Biological Systems" International Mechanical Engineering Congress & Exposition, GA
1996	Chair	Symposium "Issues in the Design and Delivery of New Molecular and Cellular Therapeutics" American Institute of Chemical Engineers Meeting, IL
1997	Chair	Session "Bioprocessing for Engineered Tissues and Gene Therapy" International Mechanical Engineering Congress & Exposition, TX
1997	Chair	Session "Microfabrication and Biological Systems" American Institute of Chemical Engineers Meeting, CA
1998	Chairman	Meeting "Microsystems Technology in Medicine and Biology", MA
1998	Steering Committee	Meeting "Biotransport 98: International Symposium on Heat and Mass Transfer in Biological and Medical Engineering", Turkey
1998	Chair	Session "Tissue Engineering Symposium" Annual Meeting of the Society for Cryobiology, PA
1998	Chair	Session "Workshop on Cryobiology of Multicellular Tissues" Annual Meeting of the Society for Cryobiology, PA
1998	Co-Chair	Meeting "Biomedical Engineering Society Spring Meeting", CA
1999	Steering Committee	Meeting "ASME-JSME (Japanese Society of Mechanical Engineering) 5th Thermal Engineering Joint Conference", TX
1999	Chair	Meeting "Biomedical Engineering Society Spring Meeting", CA
1999	Steering Committee	Meeting "Bioengineering of Nanostructures for Biomedical and Biotechnical Applications", MA
2000	Chairman	Meeting "37 th Annual Meeting of the Society for Cryobiology", MA

2000	Chair	Tissue Engineering Track "Biomedical Engineering Society Annual Meeting", WA
2001	Co-Chair	Cell and Tissue Engineering, and Biomaterials Tracks, "IEEE Engineering in Medicine and Biology Congress", Turkey
2001	Co-Moderator	Panel "Anesthesiology and Bioengineering" Health Care East and West, Moving into the 21 st Century, HMS
2001	Steering Committee	Meeting "Experiencing the Frontiers of Biomedical Technology" Harvard-MIT Division of Health Sciences and Technology
2003	Steering Committee	Meeting "Experiencing the Frontiers of Biomedical Technology" Harvard-MIT Division of Health Sciences and Technology

Editorial Board Activities:

<u>Year</u>	<u>Role</u>	<u>Name of Journal</u>
1992-	Member of the Editorial Board	Journal of Cryobiology
1997-	Associate Editor	Annual Reviews Biomed Eng
1998-	Associate Technical Editor	Journal of Biomechanical Eng
1998	Guest-Editor, Special Issue on BioMEMS	Biotechnology Progress
1999	Guest-Editor, Special Issue on Microsystems Technology in Biology and Medicine	Journal of Biomechanical Eng
1999-2003	Member of the Editorial Board	Cryo-Letters

Ad Hoc Review Activities:

Engineering and General Science Journals

American Institute of Chemical Eng Journal
Annals of Biomedical Engineering
Biomaterials
Biophysical Journal
Biotechniques
Biotechnology and Bioengineering
Biotechnology Progress
International Journal of Heat & Mass Transfer
Journal of Applied Physics
Journal of Biomechanical Engineering
Journal of Biomedical Materials Research
Langmuir
Mathematical Bioscience
Metabolic Engineering
Tissue Engineering
Nature Biotechnology
Physics in Medicine and Biology
Proceedings of National Academy of Sciences

Life Sciences and Medical Journals

American Journal of Physiology
Anatomical Records
Annals of New York Acad of Sciences
Annals of Surgery
Artificial Organs
Biology of Reproduction
Cell Biology International
Cell Transplantation
Critical Care Medicine
Cryobiology
Cryo-Letters
Hepatology
Human Reproduction
J American Soc of Artificial Internal Organs
Journal of Membrane Biology
Journal of Surgical Research
Reproductive Biology

Grants:

Alberta Cancer Board
Alberta Heritage Foundation for Medical Research
Allegheny-Singer Research Institute
Italian Ministry for Universities and Research
Israel Science Foundation
National Institutes of Health
National Science Foundation
Science Foundation of Ireland
The Whitaker Foundation
The Canadian Institute of Health Research

Consulting Activities:

Organogenesis, Inc.
W.R. Grace
Advanced Tissue Sciences
Cryo-Cell
Imetrx, Inc.
Cryo-Cath
Cambridge Scientific, Inc.
Organ Recovery Systems, Inc.

Awards and Honors:

<u>Year</u>	<u>Name of Award</u>
1977-1982	Dean's List, Mechanical Engineering, Istanbul Technical University
1981	International Exchange Student Award, French Government
1981	Ataturk, Founder of the Republic of Turkey Centenary Award, Turkey
1982	Summa Cum Laude, Mechanical Engineering, Istanbul Technical University
1982-1984	Ministry of Education Scholarship, Turkish Government
1983-1987	Medical Engineering Fellowship, Harvard-MIT HST
1987-1989	Edwin Webster Fellowship, Harvard-MIT HST
1993-1998	National Institutes of Health FIRST Award
1994	Y.C. Fung Young Faculty Award in Bioengineering, A.S.M.E.
1995-1998	The Whitaker Foundation Special Opportunity Award in Bioengineering
1997	John F/Virginia B. Taplin Faculty Fellow in Health Sciences and Technology
1998	Fellow, American Institute of Medical and Biological Engineering

PART II: RESEARCH AND TEACHING CONTRIBUTIONS:

A. Narrative Report of Research and Teaching Contributions:

The preponderance of my research has been in cell and tissue preservation with an interdisciplinary emphasis to integrate physicochemical and biological approaches. The ability to cryopreserve cells is a fundamental enabling technology for cell biology, and similarly, as we look to the next century, preservation of cell-based therapeutics will be a necessary prerequisite to their viable clinical utility. My laboratory's contribution to this field has been in establishing, through theoretical modeling and experiments, the fundamental processes associated with cell freezing, which involve a complex interplay between ice formation, water/solute transport across cell membrane, and cell injury. With an understanding of the time-evolution of these events during freezing, critical factors for cell survival have been established and used to provide rational strategies for designing cryopreservation approaches.

Most recently, my laboratory has pioneered the use of intracellular sugars against freezing stresses in mammalian cells. Sugars are used by a variety of organisms to tolerate dehydration stress (anhydrobiosis). The protective ability of sugars are believed to be related to their remarkable ability to form glassy state and to directly stabilize biological structures. In order to make use of these normally impermeable sugars, we have shown reversible permeabilization of mammalian cells to sugars by using a genetically engineered, proteinaceous, 2-nm pore, and have shown that trehalose, as a model sugar, could afford protection to mammalian cells during freezing in the absence of other cryoprotectants. The discovery that sugars could protect mammalian cells from deleterious dehydration conditions has important implications for our understanding of how anhydrobiotic organisms survive excessive water loss and can potentially lead to entirely new ways of maintaining "dried" cells in "suspended animation" on the shelf that can be "brought back to life" as needed.

In addition, we have made inroads into the emerging field of micro-systems technologies and liver tissue engineering. The essence of this work has been to merge powerful micro-systems technologies with important biological and medical problems. We have pioneered the use of microfabrication towards the creation of multicellular systems in liver tissue engineering, and have used these technologies to better understand cell interactions in hepatocyte co-cultures. We are now in the process of incorporating co-cultures into a bioartificial liver device. Furthermore, my group's vested interest in cellular systems and micro-systems technologies uniquely positions us to tackle fundamental engineering and biological issues related to the integration of living cells as components of working micro-systems called "cell-based chips" for a variety of diagnostic, drug screening, biosensor, and medical device purposes.

My teaching activities have included both didactic and informal teaching at undergraduate, graduate, and postgraduate levels. I have taught engineering thermodynamics at MIT and Rutgers University. I have coordinated and lectured in a variety of courses and seminars related to biomedical engineering. I have also led the development of a unique biomedical engineering research and education program for physician fellows. This is a full-time two-year program for M.D. fellows to get exposure to bioengineering. The courses developed for this program include: "Lab in Molecular and Cellular Sciences", "Fundamentals in Biomedical Engineering", and "Case Studies in Biomedical Engineering". I teach multiple sections in all three courses and coordinate the fundamentals and case studies courses.

B. Funding Information:

Past Funding:

1992-1995	The Whitaker Foundation (Research) Nonequilibrium Freezing of Mouse Oocytes \$180,000 (Total direct cost for the 3-year project)	PI
1992-1994	Shriners Hospitals for Children (Research) Cellular Mechanisms of Thermal Injury \$320,000 (Total direct cost for the 3-year project)	PI
1995-1998	The Whitaker Foundation (Education) Biomedical Engineering Research and Education for Physician Fellows \$670,000 (Total direct cost for the 3-year project)	PI
1995	TAP Pharmaceuticals, Inc. (Research) Human Oocyte Cryopreservation \$10,000 (Total direct cost for the 1-year project)	Co-PI (Dr. Toth, PI, MGH OB/GYN)
1995-1997	Shriners Hospitals for Children (Research) The Heat Shock Response and Repair and Thermal Damage to Cells \$398,182 (Total direct cost for the 3-year project)	PI
1996-1998	Shriners Hospitals for Children (Research) Role of Oxidative Damage in Muscle Wasting in Burn Trauma \$362,000 (Total direct cost for the 3-year project)	PI
1996-1998	Shriners Hospitals for Children (Research) Optimization of Cryopreservation Protocols for Various Human Skin Grafts \$287,000 (Total direct cost for the 3-year project)	PI
1992-2000	Electric Power Research Institute (Research) Cellular Mechanisms of Electrically Induced Thermal Injury \$210,000 (Total direct cost for the 7-year project)	PI
1998-2000	NIH (Research) Engineering of Cellular Mosaic Micro-Patterns for Studies of Cell-Cell Communication \$150,000 (Total direct cost for the 2-year project)	PI
1996-2001	Organogenesis, Inc. (Research) Development of a Bioartificial Liver Device \$1,200,000 (Total direct cost for the 5-year project)	PI
1999-2002	NIH (Research) Young from Stored and Impaired Transgenic Mouse Sperm \$291,582 (Total direct cost for the 3-year project)	PI for MGH subcontract
1999-2001	NSF (Research)	PI

Cryopreservation of Starfish Oocytes, Eggs, and Embryos
\$50,000 (Total direct cost for the 2-year project)

2000-2003 National Textile Center (Research) PI
Development of Bio-Active Fabrics
\$276,186 (Total direct cost for the 3-year project)

Current Funding:

2001-2006 Defense Advanced Research Program PI
Agency (DARPA) (Research)
Cellular Engineering for Suspended Animation
\$5,256,414 (Total direct cost for the 5-year project)

1993-2007 NIH (Research) PI
Hepatocellular Response to Cryopreservation
\$2,321,984 (Total direct cost for the 9-year project)

2002-2004 Shriners Hospitals for Children (Research) PI
Anhydrobiotic Engineering of Living Skin Substitutes
\$414,661 (Total direct cost for the 3-year project)

1998-2003 Shriners Hospitals for Children (Research) PI
The Antiproteolytic Action of Insulin in Burn-Induced Muscle Wasting Syndrome
\$808,332 (Total direct cost for the 6-year project)

2000 Grateful Patients (Clinical) Co-PI (Dr. Toth, PI, MGH OB/GYN)
Cryopreservation of Human Oocytes for the Treatment of Infertility
\$250,000 (Total)

C. Report of Current Research Activities:

Cryobiology and Biopreservation (Mechanism of cell injury under extreme dehydration; Membrane transport and control of permeability; Thermophysics of carbohydrate sugars; Dried stability of mammalian cells; Cryobiology of gametes; Clinical studies with human oocyte freezing using sugars)

Liver Tissue Engineering and Microsystems Technology in Biomedical Applications
(Micropatterned liver cell cultures; Studies of heterotypic cell interactions in liver co-cultures; Integration of living cells and micro-engineered tissue units into micro-devices)

D. Report of Teaching:

Local Courses Taught:

1995- Coordinator and Lecturer in "Tutorial in Medical Engineering and Medical
Physics" [HST 595, 596]
Harvard-MIT, Division of Health Sciences and Technology
10-15 graduate students, 20 hours/year

- 1995- Course Director and Lecturer in "Advances in Tissue Engineering" [CEM 040]
Center for Engineering in Medicine, Massachusetts General Hospital
20 postdoctoral and MD fellows, 20 hours/year
- 1995-2000 Lecturer in "Lab in Cellular and Molecular Sciences" [CEM 010]
Center for Engineering in Medicine, Massachusetts General Hospital
10-15 postdoctoral and MD fellows, 10 hours/year
- 1996- Course Director and Lecturer in "Fundamentals of Bioengineering" [CEM 020]
Center for Engineering in Medicine, Massachusetts General Hospital
10-15 postdoctoral and MD fellows, 15 hours/year
- 1996- Course Director and Lecturer in "Case Studies in Bioengineering" [CEM 030]
Center for Engineering in Medicine, Massachusetts General Hospital
10-15 postdoctoral and MD students, 15 hours/year
- 2001- Co-organizer and Lecturer in "Lab in Cellular and Molecular Sciences" [HST 505]
Harvard-MIT, Division of Health Sciences and Technology
12-15 graduate students, 30 hours/year

Other Courses Taught

- 1992-1994 Lecturer in "Engineering Thermodynamics" [2.40]
Massachusetts Institute of Technology
100-150 undergraduate students, 168 hours/year
- 1994-1995 Course Director and Lecturer in "Chemical Engineering Thermodynamics" [155:308]
Rutgers University
50 chemical engineering undergraduate students, 35 hours/year
- 1994-1995 Lecturer in "Topics in Advanced Biotechnology" [155:604]
Rutgers University
30-40 students, 10 hours/year
- 1998-2000 Lecturer in "Tissue Engineering Course"
Georgia Institute of Technology
30 students, postdoctoral fellows, faculty, 5 hours/year
- 2001 Lecturer in "Tissue Engineering: Fundamentals and Tools" [14:125:491]
Rutgers University
20-25 undergraduate and graduate students, 5 hours/year
- 2002 Lecturer in "Embryo and Oocyte Cryopreservation: Fundamental Principles,
Gamete Biology and Developmental Strategies"
American Society for Reproductive Medicine
20-30 graduate and medical students, 5 hours/year

Local Invited Teaching Presentations:

<u>Year</u>	<u>Name of Course/Presentation</u>
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- 1997- Lecturer in "Assisted Reproductive Technologies"
HST 595/596 Tutorial in Medical Engineering and Medical Physics
10-12 graduate students, 4 hours/year
- 1998 Lecturer in "Bioartificial Liver Assist Systems"
Grand Rounds, Surgical Services, Massachusetts General Hospital
30-40 surgical staff, residents, postdoctoral and MD fellows, 3 hours/year
- 1998 Lecturer in "New Approaches to the Development of Bioartificial Liver Assist Systems"
Grand Rounds, Surgical Services, Massachusetts General Hospital
30-40 surgical staff, residents, postdoctoral and MD fellows, 3 hours/year
- 2000- Lecturer in "Frontiers Lecture: Microtechnologies in Tissue Engineering"
HST 090 Pathology Course
30 MD and graduate students, 4 hours/year
- 2000- Lecturer in "Microtechnology and Hepatic Assist Systems"
HST 588 Biomaterials and Tissue Engineering in Medical Devices and Artificial Organs
25 MD and graduate students, 4 hours/year
- 2003 Lecturer in "Inflammation and the Host Response – A Genomic and Proteomic Study of Injury in Patients" Grand Rounds, Surgical Services, Massachusetts General Hospital, 30-40 surgical staff, residents, postdoctoral and MD fellows, 3 hours/year

Teaching Leadership Role in Affiliated Institution or Medical School:

- 1995- Director, Biomedical Engineering Research and Education Program for Physicians,
Center for Engineering in Medicine

Current Postdoctoral and MD Fellows:

<u>Name</u>	<u>Degree Field</u>	<u>Prior Institution</u>	<u>Project</u>
Aksan, Alptekin	PhD Mech Eng	Michigan State U	Dried storage of living cells at ambient temperatures
Bhowmick, Pragati	MD OB/GYN	Calcutta National Medical College	Oocyte cryopreservation
Elliott, Gloria	PhD Mech Eng	Michigan State U	Cells on a chip for diagnosis
Erdag, Gulsen	MD Pedi Surgery	Dokus Eylul U	Tissue engineered cultured skin substitutes
Eroglu, Ali	PhD Embryology	Justus Liebig U Germany	Cryopreservation of oocytes using sugars delivered intracellularly

Irimia, Daniel	MD, PhD Bioengineering	U of Chicago	Microsystems bioengineering
Liu, Xiang-Hong	PhD Cryobiology	U of Tennessee	Dried storage of living cells at ambient temperatures
Mokuno, Yasuji	MD Surgery	Nagoya U Japan	In vivo studies with a liver assist device
Norris, Marlaina	MD Surgery	Beth Israel Deaconess Med Ctr	Dessication tolerance of engineered skin
Palaniappan, Sethu	PhD Biomed Eng	U of Michigan	Manipulation of living cells on chips
Revzin, Alex	PhD Chem Eng	Texas A&M U	Development of a high throughput assay for blood cell identification
Shinoda, Masahira	MD Surgery	Keio U	In vivo evaluation of microfabricated Bioartificial liver assist system
Sin, Aaron	PhD Chem Eng	Cornell U	Cellular response using microsystems approaches
Sugimachi, Keishi	MD Surgery	Kyushu U	Development of a bioartificial liver assist device

Current Doctoral Students:

<u>Name</u>	<u>Institution</u> <u>Department</u>	<u>Project</u>	<u>Anticipated</u> <u>Completion Date</u>
Braff, Rebecca ^a	MIT Mech Eng	Non-stochastic nucleation of micro-bubbles in microfluidic devices for control of fluid flow and living cell sorting	2003
King, Kevin	Harvard	Characterization of cellular dynamics	2004
Muso, Taro	MIT	Study and application of micro- and nanoscale phenomena in the biomedical environment	2004

^a Co-advisor

Past Postdoctoral and MD Fellows:

<u>Years</u>	<u>Name</u> <u>Prior Institution</u>	<u>Current Position</u>
2000-02	Acker, Jason	Assoc Scientist Canadian Blood Services
2001-03	Baust, John Jr. U Binghamton	

1991-92	Borel Rinkes, Inne ¹ U Amsterdam	Assoc Prof, Surgery Daneild der Hoed Cancer Center
1992-93	Bischof, John UC Berkeley	Assoc Prof (tenured) Mech Eng, U Minnesota
1993-95	Coger, Robin UC Berkeley	Assoc Prof, Mech Eng U North Carolina, Charlotte
1993-95	Moghe, Prabhas U Minnesota	Assoc Prof (tenured), Chem and Biochem Eng Rutgers U
1993-96	Stefanovich, Peter U Lubec	Resident in Anesthesia Massachusetts General Hospital
1994-96	Thorpe, William Rutgers U	Resident in Anesthesia Massachusetts General Hospital
1994-96	Busch, Nathan Rutgers U	Asst Prof, Chem Eng Illinois Inst of Technology
1994-96	Karlsson Jens ² MIT	Asst Prof, Mech Eng U Illinois at Chicago
1996-98	Behnia, Kamelia Northeastern U	Scientist, Bristol Myers Squibb
1996-98	Ferland, Louis McGill U	Scientist Dana Farber Cancer Institute
1996-99	Fowler, Alex Duke U	Assoc Prof (tenured), Mech Eng UMass Dartmouth
1997-98	Ledezma, Gustavo Duke U	Senior Researcher PDVSA-Intevap
1997-98	Bhatia, Sangeeta MIT	Asst Prof, Biomed Eng U California, San Diego
1997-00	Balis, Ulysses U Florida	Instructor, Pathology Massachusetts General Hospital
1998-99	Bieganski, Robert MIT	Postdoc, MIT
1998-00	Folch, Albert U Barcelona	Asst Prof, Biomed Eng U Washington

¹ "Walter Brendel Award" at the 1992 European Surgical Society Meeting.

² "Crystal Award" at the 1993 Society for Cryobiology Meeting.

1998-00	Solomon, Vered Harvard U	Senior Scientist, Amgen
1999-00	Choi, Yong-Chul Boston U	
1998-00	Kim, Nam UC Berkeley	Private Practice, Surgery, CA
1998-00	Washizu, Junji Nagoya U	Surgery Staff, Kasugai Municipal Hospital
1998-00	Jeon, Noo Li U Michigan	Asst Prof, Materials Science U California, Irvine
1998-01	Tilles, Arno U Florida	Instructor, Surgery Massachusetts General Hospital
1998-01	Shito, Masaya Keio U	Asst Prof, Surgery Keio U
1999	Menguc, Pinar (Visiting Faculty)	Prof, Mech Eng U Kentucky
1999-01	Chen, Tani MIT	Patent Officer Wolf, Greenfield & Sacks, PC
2000-02	Bhowmick, Sanka U Minnesota	Asst Prof, Mech Eng U of Massachusetts Dartmouth
2000-2002	Sosef, Meindert U of Lieden	Researcher, Academic Medical Center University of Amsterdam
1997-2001	Roy, Partha	
2001-2002	Porembski, Margaret Georgetown, U	Research Fellow Georgetown U
2002	Nejat Olgac (Visiting Faculty)	Prof, Mech Eng U Conn

Past Graduate (MS and PhD) Students:

<u>Year</u> <u>Degree</u>	<u>Name</u> <u>Prior Institution</u>	<u>Current Position</u>
1994 MS	Padanilam, Joseph MIT	Consultant Myers-Holum, Inc.
1995 MS	Russo, Michael Columbia U	Senior Associate Putnam Associates

1995 MS	Gertner, Michael MIT	MD/PhD Student Cornell U
1994 PhD	Karlsson Jens ³ MI	Asst Prof, Mech Eng U Illinois at Chicago
1997 MS, PhD	Bhatia, Sangeeta ⁴ Brown U	Asst Prof, Biomed Eng U California, San Diego
1999 MS	Braff, Rebecca	PhD student MIT
1999 MS	Issa, Perla McGill U	Engineer TenFold Corporation
2001 PhD	Voldman, Joel	Asst Prof, Electrical Eng MIT

Current and Past Doctoral Dissertation Committees:

<u>Year</u>	<u>Name</u>	<u>Department/Institution</u>
1994	Busch, Nathan	Rutgers University, Chem and Biochem Eng
1994	Venugopalan, Vasan	Massachusetts Institute of Technology Department of Mechanical Engineering
1995	Thorpe, William	Rutgers University, Chem and Biochem Eng
1996	Hotamisligil, Selen	Boston College, Biology
1996	Rusotti, Greg	Rutgers University, Chem and Biochem Eng
2000	Baissalov, Roustem	University of Calgary Department of Physics and Astronomy
2001	Baust, John Jr	SUNY Department of Biological Sciences
current	Wong, Matthew	Massachusetts Institute of Technology Department of Chemical Engineering
current	Buchanan, Sandhya	Louisiana State University
current	Binello, Emanuela	Harvard-MIT Division of Health Sciences and Technology

³ "Crystal Award" at the 1993 Society for Cryobiology Meeting.

⁴ "Whitaker Graduate Student Award" at the 1995 Biomedical Engineering Society Meeting.

current	Adams, Dana	Massachusetts Institute of Technology Department of Chemical Engineering
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Past B.S. Dissertations Supervised:

<u>Year</u>	<u>Name/Institution</u>	<u>Project</u>
1991	Bae, Joseph MIT	Thermal analysis of solidification interface stability in BiSrCaCuO superconductor fiber growth
1991	Jhaderi M MIT	Heat transfer analysis of a large-scale controlled rate freezer
1991	Jansujwicz, Alan MIT	Degradation of collagen under continuous shear stress
1993	Devin, Jessica MIT	Development of 3D polymer matrix for use in bone repair
1993	Graham, Robert MIT	Design of an oxygen uptake measurement system for cultured hepatocytes
1994	Hsiao, Paul MIT	Manufacturing of porous biomaterials using directional solidification
1994	Mermerci, Ender MIT	Sensitive light based distance measurement technique
1994	Padanilam, Joseph MIT	Cellular mechanisms of thermal injury to mammalian cells
1995	Parakesh, Natesh MIT	Reperfusion injury in cultured hepatocytes

Regional, National, or International Contributions:

1989	Invited Lecture, "Cryopreservation of Oocytes" Connecticut Health Center, University of Connecticut
1990	Invited Lecture, "Principles of Oocyte Cryopreservation" Tufts University, Department of Anatomy and Cell Biology, School of Medicine
1990	Invited Lecture, "Physicochemical Aspects of Gamete Preservation" Harvard Medical School, Lab of Human Reproduction and Reproductive Biology
1990	Invited Lecture, "Foundations and Applications of Cryobiology" Surgical Grand Rounds, School of Medicine, University of Chicago
1993	Invited Lecture, "Cellular Response to Freezing Stress"

- Rutgers University, Department of Chemical and Biochemical Engineering
- 1993 Invited Lecture, "Development of Hepatocyte-Based Hepatic Support Systems"
University of California at Berkeley
- 1993 Invited Lecture, "Critical Issues in the Preservation of Bioartificial Liver Devices"
W.R. Grace, Inc.
- 1993 Invited Lecture, "Critical Technologies in the Development of a Bioartificial Liver"
Massachusetts Institute of Technology, Department of Mechanical Engineering
- 1993 Invited Lecture, "Hepatocellular Response to Freezing"
W.R. Grace, Inc.
- 1994 Invited Lecture, "Preservation of Engineered Tissues"
Advanced Tissue Sciences, Inc.
- 1995 Invited Lecture, "Nucleation and Growth of Ice Phase in Biological Systems"
University of Minnesota, Department of Mechanical Engineering
- 1995 Invited Lecture, "Hepatic Tissue Engineering"
University of Minnesota, Department of Biomedical Engineering
- 1995 Plenary Presentation, "Development of Mechanically Stimulated In Vitro Muscle Cell
Culture Systems"
Mini-Beffa Conference, American Burn Association, Albuquerque, NM
- 1995 Invited Lecture, "Engineering of Cell-Cell Interactions Using Microfabrication
Techniques"
International Conference on Cellular Engineering, San Diego, CA
- 1995 Plenary Presentation, "Thermally Driven Biological Processes"
Annual Meeting of The Society for Physical Regulation in Biology and Medicine,
Bethesda, Maryland.
- 1995 Invited Lecture, "Long-Term Hepatocyte Culture Systems"
Biochemical Engineering IX, Engineering Foundation, Davos, Switzerland
- 1995 Invited Lecture, "Experimental and Theoretical Strategies for the Development of Cell
and Tissue Cryopreservation Techniques"
Massachusetts Institute of Technology, Biotechnology Process Engineering Center
- 1995 Invited Lecture, "Hepatic Tissue Engineering"
Massachusetts Institute of Technology, Department of Mechanical Engineering
- 1995 Invited Lecture, "Primary Liver Cell Culture and Preservation"
US Army, Natick Laboratories
- 1996 Invited Lecture, "Hepatic Tissue Engineering"
Northeastern University, Bouve College of Pharmacy and Health Sciences
- 1996 Invited Lecture, "Principles of Oocyte Cryopreservation"

Tufts University, Department of Cell Biology

- 1996 Invited Lecture, "Hepatic Tissue Engineering"
Georgia Institute of Technology, School of Mechanical Engineering, GA
- 1996 Invited Lecture, "Hepatic Tissue Engineering"
University of Pittsburgh, School of Engineering, PA
- 1996 Invited Lecture, "Hepatic Tissue Engineering"
International Mechanical Engineering Congress and Exposition, Atlanta, GA
- 1996 Invited Lecture, "New Directions in Biopreservation"
American Institute of Chemical Engineers Annual Meeting, Chicago, IL
- 1996 Invited Lecture, "Novel Approaches to Minimize Intracellular Ice Formation During Cryopreservation"
Annual Meeting of the Society for Cryobiology, Indianapolis, IN
- 1996 Invited Lecture, "The Role of Hepatocyte Preservation in Hepatic Tissue Replacement"
Annual Meeting of the Society for Cryobiology, Indianapolis, IN
- 1996 Invited Lecture, "Advances in Cryosurgery and Cryopreservation Techniques"
Postgraduate Course on Plastic and Maxillofacial Surgery: New Applications of Science and Emerging Technology in Surgical Practice, American College of Surgeons 82nd Clinical Congress, San Francisco, CA
- 1996 Plenary Presentation, "Recovery of Cells Treated with Co-Polymers After Injury"
Annual International Conference of Engineering in Medicine and Biology Society, Amsterdam, The Netherlands
- 1996 Invited Lecture, "Engineering Cell-Cell Interactions in Culture"
Cell Culture Engineering V, Engineering Foundation, San Diego, CA
- 1997 Invited Lecture, "Cryobiology of Mammalian Cell"
University of Colorado, Section of Hepatology, Denver, CO
- 1997 Invited Lecture, "Hepatic Tissue Engineering" Radiation Oncology, Integrative Tumor Biology Seminar, Mass General Hospital
- 1997 Invited Lecture, "Hepatic Tissue Engineering" Mechanical, Industrial, and Manufacturing Engineering Department, Research Colloquium, Northeastern University
- 1997 Invited Lecture, "Microfabrication of Substrates for Probing Cell-Cell Communication", BAMS Seminar, MicroTechnology Laboratory, Massachusetts Institute of Technology
- 1997 Invited Lecture, "Hepatic Tissue Engineering: Development of Bioartificial Liver Assist Systems"
Grand Rounds, University of Colorado, Section of Hepatology, Denver, CO
- 1997 Invited Lecture, "Probing the Heterotypic Interface in Hepatic Tissue Engineering: Parenchymal-Mesenchymal Cell Communication"

- World Congress on Medical Physics and Biomedical Engineering, Nice, France
- 1997 Invited Lecture, "Physicochemical Principles of Mouse Oocyte Freezing and Optimal Design of Cryopreservation Protocols"
25th Anniversary of "Frozen" Mice: Embryo Cryopreservation, Bar Harbor, ME
- 1997 Invited Lecture, "Micropatterning of Hepatocyte Co-Cultures for a Bioartificial Liver"
Center for Biomedical Engineering, City College of New York, New York, NY
- 1997 Invited Lecture, "Hepatic Tissue Engineering Using Microfabrication"
Materials Research Society Fall Meeting, Boston, MA
- 1998 Invited Lecture, "Principles of Intracellular Ice Formation During Freezing of Oocytes"
Emory University, Yerkes Regional Primate Research Center Workshop in
- 1998 Invited Lecture, "Bioartificial Liver Systems"
Georgia Institute of Technology Workshop on "Tissue Engineering: Challenges and Opportunities" Atlanta, GA
- 1998 Invited Lecture, "Hepatic Tissue Engineering Using Microfabricated Co-Cultures"
Biomedical Engineering Society Annual Meeting, Cleveland, OH
- 1998 Plenary Presentation, "The Use of Poloxamer 188 in Thermal Injury"
Society for Physical Regulation in Biology and Medicine Meeting, Long Beach, CA
- 1998 Plenary Presentation, "Thermal Aspects of Electrical Burns"
3rd International Symposium on Electrical Injury, Shanghai, China
- 1999 Invited Lecture, "Microfabrication of Cell-Cell Interaction in Liver Tissue Engineering"
Symposium on Microsystems Technology in Medicine and Biology, Boston, MA
- 1999 Invited Lecture, "Microfluidic Devices for Microfabricated Cell Cultures"
Workshop on Tissue Eng, Gene Delivery, Regenerative Healing, Hilton Head, SC
- 1999 Plenary Presentation, "Microfabricated Cellular Systems for Biomedical Applications"
Transducers '99, Sendai, Japan
- 1999 Invited Lecture, "Research in Hepatocyte Function"
American Society of Internal Artificial Organs Meeting, San Diego, CA
- 1999 Invited Lecture, "Hepatic Tissue Engineering"
Workshop on Tissue Eng Challenges, Georgia Institute of Technol, Atlanta, GA
- 1999 Invited Lecture, "Biohybrid Hepatic Systems"
Gordon Conference on Biocompatibility, Biomaterials and Tissue Eng, Plymouth, NH
- 1999 Invited Lecture, "Engineering of Bioartificial Liver Assist Systems"
Department of Chemical Engineering, Johns Hopkins University, Baltimore, MD
- 1999 Invited Lecture, "Microfabrication in Tissue Engineering and Liver Cultures"
Department of Biomedical Engineering, Georgia Institute of Technology, Atlanta, GA

- 1999 Invited Lecture, "Engineering of Bioartificial Liver Assist Systems"
Department of Biomedical Engineering, Johns Hopkins University, Baltimore, MD
- 1999 Invited Lecture, "Microfabrication and Its Applications in Tissue Engineering" Electrical
Engineering and Computer Science Colloquium, MIT
- 1999 Invited Lecture, "Critical Engineering Issues in the Development of Bioartificial Liver
Assist Systems, Division of Health Sciences and Technology, Harvard-MIT
- 2000 Invited Lecture, "Microfabrication in Tissue Engineering" Symposium on
Bioengineering of Nanostructures for Biomedical and Biotechnological Applications,
Boston, MA
- 2000 Invited Lecture, "Microsystems Technologies and Tissue Engineering" Boston
University, Department of Biomedical Engineering
- 2000 Invited Lecture, "Principles of Microsystems in Tissue Engineering", Symposium on
Biomedical Polymers for the 21st Century", The Schepens Eye Research Institute
- 2000 Invited Lecture, "Fundamental Issues in the Development of Liver Assist Systems"
Division of Engineering and Applied Physics, Harvard University
- 2001 Invited Lecture, "Micromanufacturing of Cellular Systems"
BioMEMS 2000, San Fransisco, CA
- 2000 Invited Lecture, "Microsystems and Tissue Engineering"
World Congress of BioMEMS, Ohio, OH
- 2000 Invited Lecture, "Principles and Applications of Cryobiology to Engineered Tissues"
NIH Workshop in Tissue Engineering, Washington, DC
- 2000 Plenary Presentation, "Bioartificial Liver Assist Systems"
5th International Symposium on Tissue Eng for Therapeutic Use, Tsukuba, Japan
- 2000 Invited Lecture, "Microfabricated Complex Cellular Systems"
Tokyo Women's Medical University, Tokyo, Japan
- 2002 Invited Lecture, "Critical Issues in Long-Term Storage of Mammalian Cells and
Tissues"
5th Annual Hilton Head Workshop and Annual Eng Tissues, Hilton Head Island, SC
- 2001 Invited Lecture, "Cryopreservation and Drying of Liver Cells"
Workshop on Strategic Considerations for Organ Assist Systems, Helmholtz
Association of German Research Centers, Karlsruhe, Germany
- 2001 Invited Lecture, "Molecular Mechanisms of Damage to Oocytes during
Cryopreservation"
Reproductive Biology, Louisiana State University
- 2001 Invited Lecture, "Sugars as Intracellular Protectants for Dehydrated Mammalian Cells"
The Amorphous State: A Critical Review, Cambridge University, Cambridge, UK

- 2001 Invited Lecture, "Use of Sugars for Stabilization of Mammalian Cells in Dry State"
Congress on In Vitro Biology, St Louis, Missouri
- 2001 Invited Lecture, "Preservation of Engineered Tissues"
Engineering Tissue Growth International Conference, Pittsburg, PA
- 2001 Invited Lecture, "Hepatic Tissue Engineering"
International Biomedical Science and Technology Symposium, Ankara, Turkey
- 2001 Invited Lecture, "Microfabrication for Cellular Engineering"
Materials Research Society Meeting, Boston, MA
- 2001 Invited Lecture, "Hepatic Tissue Engineering"
William Maxwell Reed Mechanical Engineering Seminar, U Kentucky, Kentucky
- 2001 Plenary Presentation, "Can Cellular Life Be Turned On and Off at Will?"
The Whitaker Foundation Biomedical Engineering Conference, La Jolla, CA
- 2001 Plenary Presentation, "The Coming Merger of Living Cells and Microsystems
Bioengineering"
7th Annual Symposium on Frontiers of Engineering, National Academy of Engineering,
Irvine, CA
- 2002 Invited Lecture, "Integration of Living Cells Into Microsystems Technology"
2nd Joint Engineering in Medicine and Biology Society/Biomedical Engineering Society
Conference, Houston, TX
- 2002 Invited Lecture, "?????"Third Smith & Nephew Symposium, Georgia Institute of
Technology, Atlanta, GA
- 2002 Invited Lecture, "The Coming Merger of Living Cells and Microfabrication"
Louisiana State University, Baton Rouge, LA
- 2002 Invited Lecture, "The Coming Merger of Living Cells and Microdevices"
Nanotechnology Seminar, University of Washington, Seattle, WA
- 2002 Lecture,
- 2002 Invited Lecture, "The Merger of Living Systems and Microfabrication"
Biomedical Engineering Seminar Series, Rutgers University, Piscataway, NJ
- 2002 Invited Lecture " "
Metabolic Engineering for Cellular Stasis, Jekyll Island, GA
- 2002 Invited Lecture, Session Chair, "Bioengineering of Liver Assist Device"
5th International Hepato-Pancreato-Biliary Association World Congress, Tokyo, Japan
- 2003 Invited Lecture, Microsystems Engineering in Medicine
University of Massachusetts Dartmouth, Dartmouth, MA
- 2003 Invited Lecture,
DARPA Metabolic Engineering for Cellular Stasis, Santa Fe, NM

Professional and Educational Leadership Role Related to Teaching:

- 1994 "XI Congress of the International Society for Artificial Cells, Blood Substitutes, and Immobilized Biotechnology" MA
Program Co-Chair
Highlighted tissue engineering sciences and organ replacement therapies
- 1998 "Microsystems Technology in Medicine and Biology", MA
Program Chairman
Emphasized cellular and tissues applications of microsystems technology and engineering in a comprehensive manner for the first time at a national meeting
- 1998 "Biotransport 98: International Symposium on Heat and Mass Transfer in Biological and Medical Engineering", Turkey
Steering Committee
Focused the meeting on the cutting-edge, emerging applications of transport phenomena in biology and medicine
- 1998 "Biomedical Engineering Society Spring Meeting", CA
Program Chairman
Focused the meeting on the engineering fundamentals of genetic modification of cells and gene therapy
- 1999 "ASME-JSME (Japanese Society of Mechanical Engineering) 5th Thermal Engineering Joint Conference", TX
Steering Committee
Emphasized a broader view of thermal sciences ranging from lasers to hyperthermia in biology and medicine
- 1999 "Biomedical Engineering Society Spring Meeting", CA
Program Chairman
Focused the meeting on the fundamental biophysics of molecular transport in biology and medicine
- 1999 "Bioengineering of Nanostructures for Biomedical and Biotechnical Applications", MA
Steering Committee
Underscored the burgeoning applications of nanotechnology in medicine
- 2000 "37th Annual Meeting of the Society for Cryobiology", MA
Program Chairman
Highlighted the critical issues in desiccation of mammalian cells and tissues with special emphasis on naturally surviving schemes in plants and anhydrobiotic organisms

Description of Teaching Awards Received:

- 1997 "John F and Virginia B Taplin Faculty Fellow", Division of Health Sciences and Technology, Harvard-MIT for the development of the Biomedical Engineering Research and Education Program for Physician Fellows

Description of Innovative Educational Programs Developed:

- 1995- Biomedical Engineering Research and Education (BERE) Program for Physician Fellows: Developed a unique two-year full time research and education program for academically-oriented M.D. fellows in biomedical engineering. The educational philosophy of the BERE Program is for MD fellows to learn, work, publish, and teach together with engineering faculty, fellows, and students. The program consists of a didactic set of bioengineering courses designed specially for physicians and a research training in bioengineering. Many of the M.D. fellows joining the BERE Program have undergraduate degrees in engineering and physical sciences from top-notch schools, including Stanford U, U Oxford, Yeshiva U, U Miami, U South Florida, MIT and Duke U.

PART III: BIBLIOGRAPHY

Original Articles (refereed journals):

1. Kilic A, Toner, M. Calculation of solar collector size for water heating systems. J. Istanbul Tech. Univ. 1982; 40: 1-10.
2. Toner M, Kilic A, Onat K. Comparison of rectangular and triangular fins when condensation occurs. *Warme-und Stoffubertragung* 1983; 17: 65-72.
3. Cosman MD, Toner M, Kandel J, Cravalho EG. An integrated cryomicroscopy system, *Cryo-Letters* 1989; 10: 17-38.
4. Chu ZQ, Cravalho EG, Toner M, Biggers JD. Short-term storage of murine embryos by non-freezing methods. *Cryo-Letters* 1989; 10: 249-256.
5. Toner M, Cravalho EG, Karel M. Thermodynamics and kinetics of intracellular ice formation during freezing of biological cells. J. Applied Physics 1990; 67: 1582-1594.
6. Toner M, Cravalho EG. Kinetics and likelihood of membrane rupture during electroporation. *Physics Letters A* 1990; 143: 409-412.
7. Toner M, Cravalho EG, Armant DR. Thermodynamics of water and ion transport from mouse oocytes during freezing. J. Membrane Biol. 1990; 115: 261-272.
8. Koebe HG, Dunn JCY, Toner M, Sterling LM, Hubel A, Cravalho EG, Yarmush ML, Tompkins RG. A new approach to the cryopreservation of hepatocytes in a sandwich culture configuration. *Cryobiology* 1990; 27: 587-594.
9. Toner M, Cravalho EG, Karel M, Armant DR. Cryomicroscopic analysis of intracellular ice formation during freezing of mouse oocytes. *Cryobiology* 1991; 28: 55-71.
10. Harris CL, Toner M, Hubel A, Cravalho EG, Yarmush ML, Tompkins RG. Cryopreservation of isolated hepatocytes: intracellular ice formation under various physical and chemical conditions. *Cryobiology* 1991; 28: 436-444.
11. Hubel A, Toner M, Cravalho EG, Yarmush ML, Tompkins RG. Intracellular ice formation during freezing of cultured hepatocytes between two collagen layers. *Biotech. Prog.* 1991; 7: 554-559.
12. Bader A, Rinkes IB, Claus E, Ryan C, Toner M, Cunningham J, Tompkins RG, Yarmush ML. A stable long-term hepatocyte culture system for studies of physiologic processes: cytokine stimulation of the acute phase response in rat and human hepatocytes. *Biotech. Prog.* 1992; 8: 219-225.
13. Toner M, Cravalho EG, Yarmush ML, Tompkins RG. Transport phenomena during freezing of hepatocytes: an experimental and theoretical study. *Amer. Inst. Chem. Eng. J* 1992; 38: 1512-1522.

14. Borel-Rinkes IHM, Toner M, Ezzell R, Tompkins RG, Yarmush ML. Effects of dimethyl sulfoxide on cultured rat hepatocytes in sandwich configuration. *Cryobiology* 1992; 29: 576-583.
15. Borel-Rinkes IHM, Toner M, Tompkins RG, Yarmush ML. Long-term functional recovery of hepatocytes after cryopreservation in a three-dimensional culture configuration. *Cell Transplantation* 1992; 1: 281-292.
16. Rotem A, Toner M, Tompkins RG, Yarmush ML. Oxygen uptake rate in cultured hepatocytes. *Biotech. Bioeng.* 1992; 40: 1286-1291.
17. Toner M, Borel Rinkes IHM, Cravalho EG, Tompkins RG, Yarmush ML. A controlled rate freezing device for cryopreservation of biological tissue. *Cryo-Letters* 1993; 14: 43-56.
18. Toner M, Cravalho EG, Karel M. Cellular response of mouse oocytes to freezing stress: prediction of intracellular ice formation during freezing of biological cells. *J. Biomech. Eng.* 1993; 115: 169-174.
19. Horwitz J, Toner M, Tompkins RG, and Yarmush ML. Immobilized IL-2 preserves the viability of an IL-2 dependent cell line. *Molecular Immunology* 1993; 30: 1041-1048.
20. Foy B, Lee J, Morgan J, Toner M, Tompkins RG, Yarmush ML. Optimization of hepatocyte attachment to microcarriers: importance of oxygen. *Biotech. Bioeng.* 1993; 41: 1290-1303.
21. Toner M, Cravalho EG, Stachecki J, Fitzgerald T, Tompkins RG, Yarmush ML, Armant, DR. Non-equilibrium freezing of one-cell mouse embryos: membrane integrity and developmental potential. *Biophys. J.* 1993; 64: 1908-1921.
22. Ezzell R, Toner M, Hendricks K, Dunn JCY, Tompkins RG, Yarmush ML. Effect of collagen gel configuration on the cytoskeleton in cultured rat hepatocytes. *Exp. Cell Res.* 1993; 208: 442-452.
23. Karlsson JOM, Cravalho EG, Tompkins RG, Yarmush ML, Toner M. A model of nucleation and growth of ice crystals inside cultured hepatocytes during freezing in the presence of dimethylsulfoxide. *Biophys. J.* 1993; 65: 2524-2536.
24. Karlsson JOM, Cravalho EG, Toner M. Intracellular ice formation: causes and consequences. *Cryo-Letters* 1993; 14: 323-334.
25. Berthiaume F, Toner M, Yarmush ML, Tompkins RG. Effect of cutaneous burn injury on transport of fluorescently labeled dextrans across the rat ileum. *Critical Care Medicine* 1994; 22: 455-464.
26. Rotem A, Toner M, Tompkins RG, Yarmush ML. Oxygen is a determining factor in in vitro tissue assembly: effects on attachment and spreading of hepatocytes. *Biotech. Bioeng.* 1994; 7: 654-660.
27. Foy B, Toner M, Tompkins RG, Yarmush ML. Engineering organ perfusion protocols: NMR analysis of hepatocyte isolation from perfused rat livers. *Biotech. Bioeng.* 1994; 7: 661-674.

28. Borel-Rinkes IHM, Toner M, Tompkins RG, Yarmush ML. An extracorporeal microscopy perfusion chamber for on-line studies of environmental effects on cultured hepatocytes. *J. Biomech. Eng.* 1994; 116: 135-139.
29. Berthiaume F, Toner M, Tompkins RG, Yarmush ML. Antibody targeted photolysis of bacteria in vivo. *Biotechnology* 1994; 12: 703-706.
30. Karlsson JOM, Cravalho EG, Toner M. A model of diffusion-limited ice growth inside biological cells during freezing. *J. Applied Physics* 1994; 75: 4442-4455.
31. Foy B, Rotem A, Toner M, Tompkins RG, Yarmush ML. A device to measure the oxygen uptake rate of cultured cells. *Cell Transplantation* 1994; 3: 515-527.
32. Thorpe WP, Toner M, Ezzell RM, Tompkins RG, and Yarmush ML. Dynamics of photoinduced cell plasma membrane injury. *Biophys. J.* 1995; 68: 1-9.
33. Rotem A, Matthew H, Hsiao PH, Toner M, Tompkins RG, Yarmush ML. The activity of cytochrome P450IA1 in stable cultured rat hepatocytes. *Toxicology In Vitro* 1995; 9: 134-139.
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36. Moghe PV, Berthiaume F, Ezzell RM, Toner M, Tompkins RG, Yarmush ML. The role of culture matrix configuration and composition in maintenance of hepatocyte polarity and function. *Biomaterials* 1996; 17: 373-385.
37. Younis AI, Toner M, Albertini DF, Biggers JD. Cryobiology of nonhuman primate oocytes. *Human Reprod.* 1996; 11: 156-165.
38. Karlsson JOM, Toner M. Long-term storage of tissues by cryopreservation. *Biomaterials* 1996; 17: 243-256.
39. Bhatia SN, Toner M, Foy BD, Rotem A, O'Neil KM, Tompkins RG, Yarmush ML. Zonal liver cell heterogeneity: effects of oxygen on metabolic function of hepatocytes. *J. Cellular Eng.* 1996; 1: 125-135.
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41. Hotamisligil S, Toner M, Powers D. Changes in membrane integrity, cytoskeletal structure and developmental potential of murine oocytes after vitrification in ethylene glycol. *Biol. Reprod.* 1996; 55: 161-168.

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46. Bhatia SN, Yarmush ML, Toner M. Controlling cell interactions by micropatterning in co-cultures: hepatocyte and 3T3 fibroblasts. *J. Biomed. Materials Res.* 1997; 34: 189-199.
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55. Bhatia S, Balis U, Yarmush ML, Toner M. Probing heterotypic cell interactions: hepatocyte function in microfabricated co-cultures. *J. Biomat. Sci.* 1998;9: 1137-1160.
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65. Balis UJ, Behnia K, Dwarakanath B, Bhatia SN, Sullivan SJ, Yarmush ML, Toner M. Oxygen consumption characteristics of porcine hepatocytes. *Metabolic Eng.* 1999;1: 49-62.
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